# Mathematics

Newsletter of the Department of Mathematics at the University of Washington

## JOHN MICHAEL McPHERSON NAMED PRESIDENT'S MEDALIST

Again one of our students has been named President's Medalist for the most outstanding academic record among all graduating seniors. John Michael McPherson was a joint biochemistry and Applied and Computational Mathematics Major. McPherson was recognized for his achievement at commencement in June. He had previously received the Sophomore Medal for academic achievement. He is spending this year traveling under the auspices of a Bonderman Fellowship awarded by the Honors Program. His travels will take him through Siberia on the Trans-Siberian Railway; while in Russia he will improve his command of the Russian language. In addition to achieving academic distinction, McPherson lettered in the decathlon during his first three years.

A year ago this Newsletter reported that Kathy Temple, a joint Mathematics and Economics major, had been named President's Medalist. What we did not report at that time, because the awards were not announced until after our last newsletter went to press, was that sophomore Christopher Twigg (joint Computer Science/Math major) and junior Thomas Carlson (joint Computer Science/English/Math major) had been named Faculty Medalists on the basis of their outstanding academic records. Both Carlson and Twigg have participated in the REU– Research Experiences for Undergraduates–program in the Department, which is organized by Professors Morrow and Curtis.

Another joint Mathematics (and Economics) major, Leslie Chen, was selected to receive the award as the outstanding graduating student in the Social Sciences. (There is one such award in each of the four areas of the College of Arts and Sciences.)

*Thomas Carlson*        *Leslie Chen*        *Christopher Twigg*

## PACIFIC INSTITUTE FOR THE MATHEMATICAL SCIENCES

The University of Washington recently joined the Pacific Institute for the Mathematical Sciences (PIMS) with the support of the Mathematics, Applied Mathematics, and Statistics Departments, the College of Arts and Sciences, and the University's Office of Research.

PIMS was created in 1996 by the community of mathematical scientists in Alberta and British Columbia and was founded by a consortium of five institutions: Simon Fraser University, the University of Alberta, the University of British Columbia, the University of Calgary, and the University of Victoria, with the generous support of the provincial governments of British Columbia and Alberta, and the government of Canada through the National Sciences and Engineering Research Council of Canada.

PIMS could be described by the motto *INNOVATE, COLLABORATE, EDUCATE and DISSEMINATE.*

To promote innovation and excellence in all areas of the mathematical sciences, PIMS has created thematic programs, miniprograms, distinguished chairs and a distinguished colloquium series. The next two thematic programs are Nonlinear Partial Differential Equations (PIMS–UBC, July 2 to August 17, 2001) and Theoretical, Numerical and Industrial Fluid Dynamics (U. Alberta, June 4-15, 2001; Vancouver, August 20-25, 2001). PIMS also supports the Pacific Northwest seminar series. These are annual or bi-annual meetings that bring together various regional groups of mathematicians in areas represented by strong communities in the Northwest.

PIMS supports a large pool of postdoctoral fellows at the Canadian sites. We expect that, in association with PIMS and with the support of NSF, the University of Washington, and the private sector, our site will also be able to maintain a good postdoctoral program. Such programs are very important, for junior scientists play a crucial role in academics; they are the invigorating new blood. This is one of the ways in which our participation in PIMS will greatly impact the mathematical sciences at the University of Washington.

One of the new initiatives of PIMS is to develop an Oberwolfach-type conference center at Kananaskis, Alberta (http://www.pims.math.ca/whatsnew/pimsk.html). PIMS–K is to be a center for scientific interaction, and a major rendezvous point between the scientists of North America and those from the Pacific Rim countries.

To initiate collaboration and strengthen ties between the mathematical scientists in the academic community and those in the industrial, business, and government sectors, as well as training highly qualified personnel for academic and industrial employment, PIMS offers several programs: the Graduate Industrial Mathematics Modeling Camp (GMMC), the Industrial Problem Solving Workshop (IPSW), the Summer School in Industrial Fluid Dynamics, the School in Industrial Mathematics for Senior Undergraduates, and workshops and mini-

## A NOTE FROM THE CHAIR

I hope you will enjoy browsing our annual newsletter. The breadth of activities and achievements of our students and faculty should convince you that these are exciting times for our department. The first article demonstrates clearly that the very best undergraduates at the University of Washington are choosing mathematics as a major. We have been blessed with a significant number of fellowships and awards for our top graduate students, and our faculty continue to receive recognition for their outstanding research.

Our research environment here was highlighted this year by visits by Ed Witten (Fields Medalist), Peter Shor (Nevanlinna Prize), and Perci Diaconis (MacArthur Foundation Award). Lectures by Michael Freedman (Fields Medalist) and UW Math Professor Neal Koblitz in a celebration of the Microsoft Theory Group joining our department as Affiliate Professors were another highlight. We've begun an exciting new collaboration with Western Canadian Universities in the Pacific Institute of Mathematical Sciences. This program should greatly enhance our connections with industry and business as well as provide an infrastructure for research support.

The College of Arts and Sciences has increased its support of mathematics by providing matching funds for our new departmental research awards for several years, by selecting mathematics as the only department in the College to receive a special differential raise fund so that ten of our faculty could receive raises of over 10%, and together with the Provost's office by providing funding for substantial raises averaging nearly 30% for three additional faculty who received competitive offers from other universities. The College and the Associate Provost have provided critical support for our "Tools for Transformation" proposal for over $640,000 to fund the significant changes to our calculus program. The College and the Office of Research have also provided start-up funding for our joint project with Applied Mathematics and Statistics in the Pacific Institute of Mathematical Sciences.

Two years ago I wrote in this column that "the pattern of mathematical research is a sequence of periods of persistent, dedicated work interspersed with exciting highs at the time of discovery." At the time, we were experiencing times of re-dedication. We are now clearly on the rise – surely exciting times for our department.

We welcome your participation in the activities of our department. Let us know what you are doing with your mathematics training, help us recruit the best and brightest students to mathematics at the University of Washington, or support our work with your contributions. Of course, if you are passing through Seattle, please stop by to say hello to us in the department. You are always welcome here!

PIMS, *continued from page 1.*

courses. The fourth graduate industrial mathematics modeling camp (GMMC 4) will take place at the University of Victoria, June 11-15, 2001. The fifth industrial problem solving workshop (IPSW 5) will take place at the University of Washington, June 18-22, 2001.

The combination GMMC and IPSW has been a very successful program. As an example, last year The Michelin Group was one of the participating companies. They make tires for all types of vehicles, from bicycles to the space shuttle. Every day they produce more than 830,000 tires over a broad product range, with the smallest under 200 grams (0.5 pounds) and the biggest over 5 tons. The problem posed was: *How do you find the vibration characteristics of each of the many layers of a tire when you can only determine the composite vibrations after the tire is made?* One method is to build many tires with the various layers rotated by specific amounts. But how many tires must be made? Michelin Engineer Bill Mawbry from Michelin's research group spent the week with the team. The team, led by mentor Professor Michael Lamoureux of the University of Calgary, made significant progress in solving the problem. Mr. Mawbry said that he could see direct savings of up to $500,000 a year from their work.

Building on the strength and vitality of its programs, PIMS is able to serve the mathematics community as a catalyst in other ways. PIMS has paid special attention to the communication and dissemination of mathematical ideas through public outreach, mathematical education, and training at all school levels. *Mathematics is Everywhere* is a poster campaign featuring the ever-growing importance of mathematics in modern society. Since January, 2000, a monthly poster including a mathematics question has appeared in selected buses in Vancouver and Victoria. People are encouraged to find out more about the question and its ramifications by consulting the PIMS webpage (http://www.pims.math.ca/). As an incentive there is a prize of one hundred Canadian dollars to be given each month to one of the correct answers. One of our projects for the year 2001 is to implement a campaign like this in Seattle. To be able to fund fully the operations of PIMS in Seattle in future years as well as other PIMS activities in which we will be involved we need to find additional sources of funding. We plan to take advantage of the new NSF Mathematical Sciences Research Institutes competition to apply for support.

–Tatiana Toro, PIMS UW Site Director

## STRATEGIC PLANNING

During the 1999-2000 academic year, the department developed a strategic plan for the next five years. We were not alone; each department in the College of Arts and Sciences was asked by Dean Hodge to engage in strategic planning and to provide him by the end of the year with a report on the strategic planning process. This provided an excellent opportunity for the department to place under a common framework disparate planning efforts that were already under way, including an on-going study of departmental entry-level instruction, recently completed reviews of the undergraduate BS degree and the graduate program, and continuing discussions on future departmental hiring needs.

The Strategic Planning Report begins with a discussion of the department's values, mission statement, and broad goals, each of these topics being organized according to the three general areas of departmental activity: research, education, and outreach. This is followed by a discussion of the state of the department today, a review of the challenges the department faces, and a sketch of the appearance the department might have in 2005 if funding were sufficient to implement the ideas reported on in more detail in the document. More detailed goals are then proposed, with detailed discussion of the reasoning underlying the choice of goals and possible strategies for implementing the goals. The flavor of the report may perhaps be better conveyed through an excerpt, the department's Mission Statement:

*The Department of Mathematics is committed to excellence in the development and dissemination of mathematical ideas. In particular, the department will:*

A. *Continue a rich tradition of research in mathematics and its applications,*
- *maintaining and building a broad range of mathematical research groups of international stature while*
- *improving the quality and vigor of research interactions within the department, with other units on campus, nationally, and internationally.*

B. *Offer high-quality mathematical education at all levels,*
- *providing innovative instruction in entry-level and intermediate courses;*
- *developing a diverse program of upper-level courses for mathematics majors and other students with mathematical interests; and*
- *maintaining a vibrant graduate program that prepares students for a variety of mathematical careers.*

C. *Pursue opportunities for outreach in the Puget Sound region and Washington State,*
- *working with schools and community colleges to provide a coherent mathematics education for Washington students while*
- *strengthening research and educational ties with commercial users of mathematics.*

As noted, the department has formulated accompanying goals and strategies. Among the goals are the department's intention to: maintain and enhance the quality of the research faculty; strengthen interdisciplinary research; provide excellence in pre-calculus, calculus, and intermediate-level mathematics instruction; revise and strengthen the Bachelor's degree programs; attract a diverse group of highly-qualified graduate students; provide programs to prepare graduate students for a variety of careers; collaborate with schools and community colleges in the region; and develop educational partnerships with companies in the region.

The department is always engaged in planning, as any organization must be. At the beginning of the year, the benefits of a comprehensive planning process were not clear, given the planning activities already under way. By the end, the process proved to be rewarding indeed. Faculty, staff, and students had the opportunity to participate in a variety of ways. For example, several department meetings were held to discuss specific issues, such as hiring and entry-level instruction. Other meetings were held to review drafts of the planning report, with each draft being made available to faculty for review and comment. The process brought to light the main issues facing the department and allowed faculty members to reach a concensus on what can be done to address these issues. The report is not the end of the story. Planning is a dynamic process. As progress is made in meeting goals and as challenges change, the department will assess its performance and revise its plans accordingly.

You are invited to visit http://www.math.washington.edu/~irving/plan.html in order to examine the complete Strategic Planning Report. Comments on the report would be especially welcome. They can be sent to chair@math.washington.edu or to Professor Donald Marshall, Chair, Department of Mathematics, Box 354350, University of Washington, Seattle, Washington 98195-4350.

## PROMOTIONS

During academic 1999-2000, the Department had four promotions:



Assistant Professor Zhen-Qing Chen has been promoted to Associate Professor. Professor Chen is a probabilist.



Assistant Professor Daniel Pollack has been promoted to Associate Professor. Professor Pollack works in differential geometry and partial differential equations.



Associate Professor Steffen Rohde has been granted tenure. Professor Rohde's subject is complex analysis.
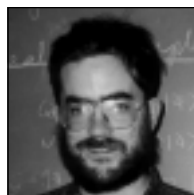


Associate Professor William McGovern has been promoted to Full Professor. Professor McGovern works in representation theory.

## SPRING AWARDS CEREMONY

On May 30, awards were presented by various faculty members to eight undergraduate and three graduate students in the department. The awardees received checks and certificates; in addition, the undergraduates received books. The awardees were Samar Hassouneh (outstanding student, honors calculus), Jeff Giansiracusa (outstanding student, honors advanced calculus), Thomas Carlson (Gullicksen Award for outstanding junior), Tarn Adams (outstanding senior, Pure Math), Paul Limont (outstanding senior, Math Sciences), Richard Cutts Peaslee (outstanding senior, Liberal Arts), Leslie Chen (outstanding senior, Teacher Preparation), Timothy Hu (outstanding performance, Putnam Examination), Avanti Athreya, Assad Ebrahim, and Shane Horner (all for excellence in teaching).

The department extends its congratulations to all of these students for their fine work.



*Pictured l–r:* Jeff Giansiracusa, Assad Ebrahim, Avanti Athreya, Tarn, Adams, Thomas Carlson, Timothy Hu, Richard Cutts Peaslee, Leslie Chen, Paul Limont.
*Not pictured:* Samar Hassouneh, Shane Horner.

## RETIREMENTS

Professor Jack Segal retired from the Department at the end of Autumn quarter, 1999, with the title of Professor Emeritus of Mathematics. Jack received his doctorate from the University of Georgia in 1960 and joined our faculty in September of the same year. His mathematical research was in geometric topology. He served the Department as chair from September, 1975, through June, 1978. He was also Acting Chair during the summers of 1987,1989, 1990, 1992, 1994 and 1997.

A reception honoring Jack upon his retirement was held on May 30, 2000, at the Faculty Club. Sibe Mardešic of the University of Zagreb, one of Jack's co-authors, spoke about working with and knowing Jack. Professor Ed Curtis and Jack's brother also spoke at the dinner that followed the reception.

A second retirement from the Department was that of Professor Branko Grünbaum at the end of Winter Quarter, 1999, at which time he also became Professor Emeritus of Mathematics. Branko studied in Yugoslavia and Israel and received his doctorate from the Hebrew University in Jerusalem in 1958. He taught at the Hebrew University and at Michigan State University before joining our department in 1966. He is widely known for his work in geometry and combinatorics. He was a Guggenheim fellow, is a Corresponding Member of the Yugoslav Academy of Sciences, and a Fellow of the American Association for the Advancement of Sciences.

Professor Grünbaum was one of the honorees at the Klee-Grünbaum Geometry Festival held in Ein Gev, Israel, in June, which is discussed in another article in this Newsletter.
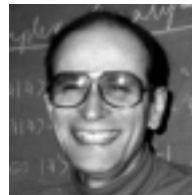


*Jack Segal*



*Branko Grünbaum*

## PRIZES

**Clay Institute Offers Millenium Prizes**
The Clay Mathematics Institute, headquartered in Boston, has announced prizes of one million dollars for the solution of each of seven mathematical problems. The prizes were announced on May 24, 2000, in Paris at the Collège de France. The oldest of the problems is the Riemann Hypothesis, concerning the location of the zeros of the Riemann zeta function, which dates from the middle of the nineteenth century. Another old problem on the list is the Poincaré Conjecture, which concerns a possible characterization of the three-sphere. Other problems are newer, *e.g.*, the problem "P vs. NP," which is a problem from contemporary theoretical computer science. None of the problems are easy; the solver of any one of them will have, in addition to a million dollars, an assured niche in the history of mathematics. The prizes have been widely reported in the international press as well as on radio and television. Full details of the prizes are available at the Clay Institute's website: http://www.claymath.org.

**Faber and Faber offers Goldbach prize**
The English publishing house Faber and Faber is offering a prize of one million dollars for a solution of the Goldbach Conjecture. This conjecture, which is 250 years old, states that every even integer is the sum of two primes. The conjecture has been verified for numbers up to 400 trillion. Details of the prize are available at Faber's website: http://www.faber.co.uk.

## DIACONIS DELIVERS WALKER-AMES LECTURE

Persi Diaconis, Mary Sunseri Professor of Mathematics and Statistics at Stanford University, visited the University of Washington from October 15 to October 19, 2000, as a Walker-Ames Lecturer. His visit was hosted by the Departments of Mathematics and Statistics. Persi Diaconis is a distinguished and colorful mathematician. He is noted for his brilliant insight into the work of complicated mathematical and statistical problems and for his broad interests, which include number theory, combinatorics, group representation, random matrices, probability theory, and statistics.

Diaconis's Walker-Ames Lecture, which was delivered to a standing-room-only crowd in Kane Hall, was entitled "On Coincidences." In it he explained with several striking examples how a modicum of statistical thinking can be used to understand that apparent coincidences should not be regarded as surprising and how such reasoning can successfully debunk various pseudoscientific claims. In addition to this lecture, he spoke on "Probability, statistics and the zeros of the zeta function" in the Probability Seminar and on "What do we know about the Metropolis algorithm?" in a joint colloquium of the Departments of Mathematics and Statistics. Because he is well known to be an outstanding speaker, his talks draw large audiences from a variety of disciplines. As Professor Michael Perlman from UW Statistics department put it "His presence on any campus is always electrifying, .... It is certain that numerous mathematical seeds will be sown here during his tenure as a Walker-Ames Fellow."

Professor Diaconis has received many awards for his work. He has received the MacArthur Award, won the Rollo Davidson Prize, and is a fellow of the American Academy of Arts and Sciences and a member of the National Academy of Sciences. He is an ex-president of the Institute of Mathematical Statistics. Professor Diaconis started as a professional magician at age fourteen and invented many new tricks, some of which rely on probabilities. He has become an expert in many real-life problems, such as statistical problems related to ESP, birthday problems, and fast picture generation. His famous solution to the problem "How many times should a deck of cards be shuffled to mix it?"–the answer is seven–has caught nationwide attention not only in academia but also among the general public.

## THE MILLIMAN LECTURES

Each year the Mathematics Department invites a distinguished mathematician to visit the department for a week and deliver a series of lectures called the Milliman Lectures. This Lectureship is funded by the Milliman Fund, an endowed fund established in 1983 by a gift from Grace Milliman Pollock and her husband, S. William Pollock, in honor of Mrs. Pollock's brother, W. A. Milliman, who received his Mathematics degree from the University of Washington in 1926.

The 1999-2000 Milliman Lecturer was **Peter Shor** of AT&T Labs Research, who visited the department during the week of May 1-5. His lectures were entitled:
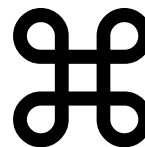
1. Quantum algorithms
2. Quantum error correction
3. Quantum information theory

Dr. Shor is one of the world leaders in the novel subject of quantum computing—he recently received the Nevanlinna Prize and one of the MacArthur Foundation's "genius" fellowships for his work in this direction. Quantum computers are hypothetical machines that use principles of quantum mechanics for their basic operations. They will be very difficult to build; however, there seem to be no physical laws that would preclude their construction. Peter Shor showed that a quantum computer could factor large integers in polynomial time, which would be fatal for all currently used public key cryptosystems (for instance, those used when one is shopping over the internet).

The Milliman Lectures attracted a wide audience, not just from the Mathematics Department, but also from the departments of Physics, Computer Science, and Microsoft Research.

Shor's lectures are the first of the Milliman Lectures to be delivered by a mathematician from the industrial world as opposed to the world of academia.

The 2000-2001 Milliman Lecturer will be Charles Fefferman of Princeton University.

## EDWARD WITTEN VISITS THE UNIVERSITY OF WASHINGTON

Edward Witten, Professor of Physics at the Institute for Advanced Study in Princeton and at the California Institute of Technology and the world's leading string theorist, visited the University of Washington on February 7-8 under the joint sponsorship of the Mathematics and Physics Departments. He gave a special Jacobsohn/Milliman Lecture on February 7 with the title "Strings, Quark Confinement, and Black Holes," which was heard by a standing-room-only crowd of approximately 450 in Kane 120.

A reception was held for Professor Witten at the Faculty Club after the lecture. He also delivered a seminar talk on February 8 entitled "Connectedness of the Boundary in the AdS/CFT Correspondence."

Witten is known for his many deep contributions at the interface of mathematics and physics. Among the many honors he has received is a Fields Medal in 1990, usually regarded as the mathematical equivalent of a Nobel Prize.

The Mathematics and Physics Departments are pleased to have collaborated in hosting such an exceptional visitor to UW. We hope there will be similarly successful collaborations between the two departments in the future.

## MICROSOFT LECTURES AND RECEPTION NOTE DEPARTMENT'S AFFILIATE PROFESSORS

On the first of May, the Department and the Microsoft Corporation celebrated the appointment of six Microsoft Theory Group members as affiliate professors in the Mathematics Department with a program of lectures followed by a reception held on the Microsoft campus in Redmond.

The program was chaired by Jennifer Chayes, the leader of the Theory Group at Microsoft. After welcoming remarks by Chayes and a few remarks by Mathematics Department chair Don Marshall, there were two lectures. The first, by Michael Freedman of Microsoft, was "Quantum Computation and the Localization of Modular Functors." The second lecture was given by Neal Koblitz of the Mathematics Department and had the title "How Pure Mathematics Almost Killed E-Commerce."

After these two lectures, a reception was held, which afforded the occasion for informal conversations among the attendees from the Mathematics Department and those from Microsoft.

## SIAM WORKSHOP

The SIAM Northwest Regional Mathematics in Industry Workshop was held at the University of Washington, October 12–14, 2000. (SIAM is the Society for Industrial and Applied Mathematics.) This was the fifth workshop in a series of regional meetings focusing on the role of mathematics in industry. These workshops (funded by an NSF grant to SIAM) are intended to provide a forum for discussion of applied/industrial mathematics programs and activities. See http://www.siam.org/mii for pointers to this and previous workshops in the series and the SIAM Report on Mathematics in Industry.

The goal of the Northwest Workshop was to facilitate discussion between faculty, students, and mathematicians working in industry and national laboratories. The program featured talks by representatives from local industry describing both their technical work and the opportunities for collaboration with academia and for summer internships. Additionally a number of university programs designed to enhance university/industry interactions or to prepare students for careers in industry were described, and there were discussions of related undergraduate and graduate curriculum issues. Current and former students described their experiences working in industry and national laboratories, while parallel sessions focused on more specific problem areas. The meeting included field trips to the Boeing Everett plant and to Microsoft Research, as well as a dinner at the Waterfront Activities Center.

One of the surprises of the meeting (to this observer) was the increasing emphasis on discrete mathematics and other areas once considered "pure mathematics" in applications such as cryptography. Traditionally, industrial mathematics has meant largely partial differential equations and numerical analysis, together with some optimization. It was good to see a broader spectrum of mathematics being applied to current problems in technology.

–Anne Greenbaum

## NEW FACULTY

The Department has been able to make several new appointments in the last year.

Sándor Kovács was appointed as an Assistant Professor. He received his PhD from the University of Utah in 1995 and was an Assistant Professor at the University of Chicago. He works in algebraic geometry, complex geometry, and commutative algebra.

Rekha Thomas was appointed as an Assistant Professor. Her PhD was granted by Cornell University in 1994. Her subject is computational algebra. Before coming to our department, she was an Assistant Professor at Texas A&M.

David Wilson has been appointed Affiliate Assistant Professor. His PhD is from MIT and was earned in 1996. He works in stochastic processes, computer algorithms, probability, and combinatorics. Affiliate professors are persons whose main professional position is outside the department, perhaps in some other department of the university or perhaps at a business or industrial firm. Dr. Wilson is an employee of Microsoft.

Patrick Perkins has been appointed Lecturer and Acting Director of the Department's Math Study Center. He received his PhD from the University of Washington in 1988.

Edward Thayer from Zymogenetics has been appointed Lecturer in our evening program. His subject is computational biology and minimal surfaces. His PhD is from the University of Massachusetts–Amherst, 1994.

Marek Biskup, Peter Garfield, and Daniel Gottesman have also been newly appointed as Lecturers.

## VISITORS

The Department welcomes several visitors this year.

Alexandre Boukhgueim is a Visiting Professor during Autumn Quarter, visiting from the Russian Academy of Sciences in Novosibirsk. His PhD was granted by the Russian Academy of Sciences in 1974. He works on inverse and ill-posed problems in mathematical physics, integral equations, and tomography.

Alicia Canton is a Visiting Postdoctoral Scholar from the University of Madrid and is supported by a fellowship from the Ministry of Education, Spain.

Ana Granados is also a Visiting Postdoctoral Scholar from the University of Madrid. She is supported by a Fullbright Fellowship and a fellowship from the Ministry of Education, Spain.

Federico Marchetti is a Visiting Professor during Autumn Quarter. He is from the University of Turin and received his PhD from the University of Rome in 1968. He studies probabilistic convergence concepts, Brownian motion, and financial mathematics.

Elena Pezzoli is Visiting Assistant Professor from Boston College. Her PhD was granted by Stanford University in 1998. She works in logic and computational complexity, complexity of higher order functionals, lambda calculus and combinatory logic, combinatorics, and biological computation.

Victor Sirvent will be Visiting Associate Professor during Spring Quarter. His subject is dynamical systems, ergodic theory and fractal geometry. He received his PhD from the University of Warwick in 1993. His home institution is the Universidad Simon Bolivar in Caracas.

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## OUTSTANDING GRADUATE STUDENTS RECOGNIZED AT AWARDS CEREMONY

On October 19, the Math Department lounge was festive for our first annual Graduate Student Awards Ceremony. This was an opportunity for faculty, staff, students, and friends of the department to applaud the outstanding achievements of some of our most talented graduate students.

Highlighting the occasion were the announcements of some new awards: the Math Department's Excellence in Teaching Awards (initiated last year), and Academic Excellence Awards, given for the first time this year. A total of eight students were honored with one or both of these awards. The Excellence in Teaching Awards were presented to the graduate students whose performance as teaching assistants in entry-level courses during 1999-2000 was most outstanding, based on feedback from their students and faculty supervisors. Each award comes with a $1000 supplementary stipend. This year's winners were:
- Amy Ehrlich (third-year PhD student from Indiana University),
- Alexandra Nichifor (fourth-year PhD student from Jersey City State College).

The winners of last year's Excellence in Teaching Awards were also recognized at the ceremony: Avanti Athreya, Assad Ebrahim, and Shane Horner.

The Academic Excellence Awards were new this year. Created with funds from the Allendoerfer endowment (named after Carl B. Allendoerfer, chairman of this department in the 1950's and well known for his research in differential geometry) and the Graduate Support Fund (funded by donations from math department faculty members, partially matched by contributions from Microsoft Corporation), these awards were given to the PhD students whose performance in core courses and preliminary exams during 1999-2000 was most outstanding. Each of these awards also comes with a $1000 supplementary stipend. This year's winners of the Faculty Academic Excellence Awards were:
- Robert Hladky (second-year student from Oxford)
- Joan Lind (third-year student from Augustana College)
- Keir Lockridge (second-year student from Rice)
- Jason Swanson (second-year student from UW)

The winners of the Allendoerfer Academic Excellence Awards were
- Amy Ehrlich (third-year student from Indiana University),
- Gregory Markowsky (second-year student from Univ. of Maine),
- Younggu Moon (second-year student from Yonsei Univ., Korea).

A number of other awards were recognized at the ceremony:

**McFarlan Fellowships**: Funded by a bequest from Lee McFarlan, a former member of the Math Department, these awards go to advanced PhD students who have shown outstanding performance in our graduate program and impressive achievements in their dissertation research. Each award consists of three quarters of fellowship support without teaching duties. The recipients for 2000-2001 are:
- Robbie Mouat (sixth-year student from the University of Canterbury, New Zealand, studying dynamics with Selim Tuncel),
- Alexandru Tamasan (fourth-year student from Babes-Bolyai University in Romania, studying inverse problems with Gunther Uhlmann).

**ACMS/VIGRE Fellowships**: three-year awards consisting of eight months of fellowship support each year without teaching duties, funded by a $2.7 million grant from the National Science Foundation's VIGRE (Vertical Integration Grants for Research and Education) program. New ACMS/VIGRE fellows for 2000-2001 are:
- Matthew Blair (first-year student from Michigan State),
- Christina Merten (first-year PhD student from Univ. of Texas at Dallas),
- Jesse Ratzkin (sixth-year PhD student from Berkeley, studying differential geometry with Dan Pollack).

In addition, the following PhD students have continuing ACMS/VIGRE fellowships that were awarded last year:
- Daniel Fox (fifth-year student from Harvard, studying geometric measure theory with Tatiana Toro),
- Christopher Green (second-year student from Washington U.),
- Marshall Hampton (sixth-year student from Stanford, studying classical mechanics with Robin Graham),
- Michael Van Opstall (third-year student from Hope College, studying several complex variables with Robin Graham).

**ARCS Fellowships**: These are three-year $15,000 cash supplements awarded by the ARCS (Achievement Rewards for College Scientists) Foundation to assist in recruiting top-notch graduate students. This year's new ARCS fellow is:
- Davis Doherty (first-year student from Rochester).

In addition,
- Jason Swanson (second-year student from UW).

has a continuing ARCS fellowship originally awarded in 1999.

**Microsoft Scholar Awards**: four-year $20,000 cash awards funded by a generous gift to the department from Microsoft Research, also to help recruit outstanding PhD students. There are currently four Microsoft Scholars in the department. New for 2000 are the following students:
- Kris Kissel (first-year student from Univ. of Pittsburgh),
- David Maxwell (first-year student from Waterloo),
- Hui Xu (first-year student from Wuhan Univ., China);

and continuing from 1999 is:
- Robert Hladky (second-year student from Oxford).

**Graduate School Merit Awards**: These are one-time $5,000 recruitment awards funded by the UW graduate school to further enhance our ability to recruit the best graduate students. This year's recipients are:
- Jesse Groman (first-year student from Oberlin),
- James Harmon (first-year student from MIT),
- Edwin O'Shea (first-year student from University College, Cork, Ireland),
- Michael Story (first-year student from Univ. of Chicago).

**NPSC Fellowships**: Funded by the National Physical Science Consortium and awarded on the basis of a national competition, these awards provide full fellowship support for up to six years in a participating doctoral program in the physical sciences (including mathematics). One of this year's sixteen NPSC fellowships went to UW math PhD student
- Sarah Brown (first-year student from Oberlin).

These students all worked extremely hard for these accomplishments and continue to work extremely hard as they pursue their goals of graduate degrees in mathematics. Everyone in the department can be proud of their accomplishments. The private donations that fund these awards are a precious resource for the mathematics department, and are invaluable in encouraging mathematics students at crucial points in their careers as well as compensating in some small measure for the inadequacy of the TA salaries we are able to pay. It is gratifying to note that the amount of funding for graduate student support has increased in recent years, with the new Hewitt Fund and Faculty Endowment (which will be added to the list of sources of support next year). We deeply appreciate the continuing generosity of our friends in supporting mathematics graduate education.

## PHANTOM WORKS: A MATHEMATICAL INTERNSHIP AT BOEING

During the summer of 2000, I spent a two month internship working at Phantom Works, the "advanced research and development unit" of the Boeing Company. Phantom Works is a center of mathematicians and mathematically inclined scientists working on mathematical problems connected with Boeing's products.

The opportunity for the exchange was funded by the NSF VIGRE grant administered jointly by the Departments of Mathematics, Applied Mathematics and Statistics. The idea of the exchange is to allow a graduate student to work closely with a mathematics group within Phantom Works, preferably on a project deep enough to enhance the student's professional training, valuable enough to be of use to the Boeing Company, and yet self-contained enough to allow a significant portion to be completed in two months of full-time work.

My work was done within the Geometry and Optimization group where I met half a dozen graduate alumni of the University of Washington, including two from our own Mathematics Department.

My project was to develop an industrial standard, C language software library capable of generating accurate representations of the efficient frontier or trade-off surface in Multi-Objective Nonlinear Pareto Optimization problems. My program (written in C) uses as its computational core existing single-objective optimizers (written in Fortran) that were already part of Boeing's collection of internally developed advanced mathematical software.

At the end of the summer's work, I had successfully completed the software library and had it documented according to Boeing's internal software library specifications. The code I developed will be part of the Optimization Group's "beta release" of the larger "Design Explorer" project later this year.

A few reflections on the experience:

1. One doesn't need to be a "software developer" to develop industrial quality mathematical software. I found that willingness to work hard and to attend carefully to details plus, of course, a reasonable familiarity with the language, is sufficient.

2. An internship like this is an invaluable opportunity to get a low-stress, morale-boosting experience in an industrially oriented mathematical research and development setting. At lunch, around the coffee pots, and at seminars, the mathematicians at Phantom Works were willing to open up windows into their work and its place within the larger context of the Boeing Company. This glimpse into a mathematical world outside academia was to me undoubtedly the most valuable part of it.

3. For those curious: a Masters degree and experience akin to such an internship gets a salary starting at about $60K doing the kind of work I was doing.

If you'd like to hear more about my internship, drop by to chat or contact me by e-mail.

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Graduate Student, Mathematics
ebrahim@math.washington.edu

## UNIVERSITY OF WASHINGTON AWARDED NSF-CSEMS GRANT

The University of Washington is one of a select number of institutions to receive funding from the National Science Foundation for Computer Science, Engineering, and Mathematics Scholarships (CSEMS). The grant of $220,000 provides funding for approximately 80 one-year scholarships of $2,500 to talented, low-income undergraduates in the College of Engineering, the departments of Computer Science and Mathematics, and the Applied and Computational Mathematical Science (ACMS) program. The grant is administered through the College of Engineering and supervised by Professors Edward Lazowska, Department of Computer Science & Engineering and Tom Duchamp, Department of Mathematics.

All recipients of CSEMS awards formally enroll in the job placement program run by the Engineering Co-op Program of College of Engineering. Co-op placement includes an industry mentor for every student, with follow-up by Co-op staff. In addition, all recipient receive a scholarship for membership in a professional society of their choice and participate in quarterly seminars and panel discussions related to professional development, applying to graduate school, and exploring professional careers.

## MATHDAY

The eleventh annual Mathday will be held on the campus of the University of Washington on March 19, 2001. On that day 1200 high school students from around the state will attend lectures and panel discussions, participate in hands-on activities, and go on field trips to labs on the campus. This year the plenary speaker will be Cliff Mass from the Department of Atmospheric Sciences. Guest lecturers will include speakers from the Mathematics, Statistics, Computer Science, and Public Health Departments as well as from local companies including Zymogenetics and Microsoft. There will also be field trips to Fisheries, Aeronautics, the HIT lab and activities involving puzzles and geometric models. Undergraduate students, graduate students, staff, and faculty contribute to the success of this exciting, educational day in which students learn about the uses of mathematics in academic and industrial research and development.

## DEPARTMENT RECEIVES GIFTS OF BOOKS

We gratefully received a large box of books donated by Dr. Elizabeth (Vaughan) Holmes. Elizabeth received her B.Sc. in Mathematics from us in 1931, and thereafter a PhD in Statistics from Stanford University in 1955. Of special interest to us were seven books by former professors of our Department, E.T. Bell, Z.W.Birnbaum, R.E.Moritz and R.M.Winger. These books are being used to begin a Departmental collection of books written by our faculty. If you have any books written by former UW math professors and would like to donate them to our collection, look for the list of needed books soon to be posted on our department web page, http://www.math.washington.edu.

A second gift of books—seven boxes—was provided by a friend of the department, Dorothy Johnson. These books were passed on to the University Library for its use.

We do appreciate these gifts from our alumni and friends.

## FRESHMAN MATHEMATICS IN THE HIGH SCHOOLS

An all too familiar comment received by our freshman mathematics instructors goes something like this: "I took Precalculus (or Calculus) in high school and did really well, but this course is totally different." This distressing situation may be caused by the student's high school courses offering a very different emphasis or because their level of mastery of the material is not up to that expected at the UW. Last year, in one effort to address this sort of situation, an experimental collaboration was begun between UW Educational Outreach (UWEO) and the Mathematics Department, offering UW credit for certain mathematics courses taught in western Washington high schools. The program started under the oversight of Ken Plochinski and involved two schools and two particular mathematics courses: Math 120 Precalculus at South Kitsap High School in Bremerton and Math 127 Calculus I at JFK High School in Burien. This year, under the oversight of David Collingwood in the Mathematics Department, the experiment is continuing.

The UWEO program for the 2000-01 academic year involves four teachers, three high schools, three of our freshman level courses and approximately 100 students. Two teachers, Kim Schjelderup and Lynn Adsit at Mercer Island High School, are teaching one section of Math 120 Precalculus and one section of Math 124 Calculus I. Paul McMillen at JFK High School in Burien will be participating for his second year in the program, teaching one section of Math 127 Calculus I. Finally, Teri Hughes at South Kitsap High School in Bremerton will be teaching one section of Math 120 Precalculus.

One shared concern over such a program is the extent to which courses will be comparable to equivalent offerings at the UW. For this reason, fairly careful monitoring of the courses will take place. This began with a day-long workshop in mid-August at which all the teachers involved were exposed to the materials used in our classes, their emphasis and the level of understanding we expect. The courses taught in the high schools will use the same textbooks (in some cases augmented by a second text). Professor Collingwood is meeting regularly with each of the teachers, on site, collecting course materials that will be available for interested members of the department to peruse and assess the course level. At the end of the year, on a Saturday afternoon in early June, these 100 high school students will sit for the same common final exam offered on the UW campus. Students will receive a UW grade and credit for the course, which will be in addition to (and not necessarily the same as) their high school grade.

It is our hope that exposing a core group of high school teachers to our freshman level courses will begin a larger dialog that improves the high school mathematics preparation of freshman entering the UW.

## SPRING PICNIC

Sunny weather for our spring picnic was masterfully arranged (along with other details) by Ginger Warfield. The graduate students challenged the faculty to a match in the sport of their choice, which, by default, was ultimate frisbee—no one remembered to bring the gear for any other sport. The graduate students have pledged to redeem themselves next year after an 11-0 trouncing by their more senior colleagues. We wish them well in their attempt.

## NEW PLAQUES IN THE LOUNGE

The Mathematics Department lounge now has four attractive cherry plaques hanging on its north wall. The plaques bear the names of the recipients of recent student awards. One lists the names of the students who have done best in the Putnam Mathematical Competition, another lists the names of students who have received awards for their performance in the honors calculus sequences, a third lists the recipients of the Gullicksen Memorial Award, and the fourth lists the TAs who have been given awards for excellence in their teaching.

The plaques were made by our colleague Hart Smith, to whom we extend our thanks for his efforts.

## DEPARTMENTAL EXCELLENCE AWARDS

We are pleased to announce the first annual Mathematics Department Excellence Awards. After careful review of each faculty member in the department by the personnel committee and the Chair, the following three associate professors and one assistant professor were chosen to receive the first round of awards for their outstanding research:

Chris Hoffman, Steffen Rohde, Tatiana Toro, and James Zhang.

Chris Hoffman is noted for his work in dynamical systems. Steffen Rohde is a well known classical analyst. Tatiana Toro contributes actively to the field of geometric analysis. James Zhang is a leader in the rapidly developing subject of noncommutative algebraic geometry.

These $4000 awards can be used during the period September 16, 2000, through September 15, 2001, at the discretion of the recipient (subject to state regulations) for research support including, but not limited to, travel, visitor support, books, equipment, and summer salary. These awards, which are expected to be the first of a series of annual awards, were provided in part from private resources and in part from the resources made available by the College of Arts and Sciences.

## NEW COURSE IN MATHEMATICAL COMMUNICATION

As reported in last year's Newsletter, the Departments of Mathematics, Applied Mathematics and Statistics have jointly received a VIGRE grant to fund new mathematical activities. One of the initiatives funded by the VIGRE grant is the development of a course intended to develop the writing and speaking skills of students in the mathematical sciences. After some experimentation over the past two years, two such courses have now been established, one for undergraduates and one for graduate students, both offered jointly by Mathematics, Applied Mathematics, and Statistics. The undergraduate course has been developed mostly by Professor Gerald Folland of the Mathematics Department. It is concerned with the writing of good mathematical prose, from the grammar of mathematical symbols to the construction of a logical argument to the organization of a paper; some attention is also given to oral presentations. The plan is to offer it once a year, to a class of about fifteen students. A graduate-level course with the same goals has been offered by Professor Peter Guttorp of the Statistics Department.

## REU PROGRAM AT THE UNIVERSITY OF WASHINGTON

The National Science Foundation supports Research Experiences for Undergraduates in various disciplines at selected universities. The University of Washington Mathematics Department has been an REU site since 1988. This program is directed by Ed Curtis and Jim Morrow. The students in the program are undergraduates selected in a competitive process from universities throughout the United States. Each year eight to ten students are selected and are given a stipend from the NSF grant that supports an eight week stay during the summer in which they participate in research projects under the direction of Professors Curtis and Morrow.

The projects are in the general area of "inverse problems for electrical networks." After a week of lectures and reading, students start to work on projects. The students in this program are exceedingly strong. In summer, 2000, students came from UW, Montana, Cal Irvine, Pomona, University of Florida, Florida State, and Notre Dame. A student from summer, 1999, presented a paper at the January, 2000, meeting of the MAA. Recent graduates have received NSF Fellowships, a Sloan Fellowship, honorable mention in the Alice T. Schafer Contest, first place in the SIAM modeling competition, and have gone on to become faculty at such universities as UCLA, Washington State, Courant Institute, and MIT. There are frequently two or more University of Washington undergraduates in the program. Our experience is that the UW students are always among the best of this talented group. Both Christopher Twigg and Thomas Carlson (see page 1) were students in our REU program. Three REU students are continuing their research work at the University of Washington and are supported by the VIGRE grant.

## COMMUNITY COLLEGE SYMPOSIUM

The first annual Community College Symposium at the University of Washington was held on Friday, November 17, 2000. The purpose of the symposium was to facilitate communication between the Mathematics Department of the University of Washington and the Mathematics Departments of the Community Colleges. This first meeting concentrated on recent and proposed changes in first and second year courses at the University of Washington. We hope to make the symposium an annual event to promote discussion of common issues.

At the plenary session an overview of recent and planned changes to our undergraduate courses and degrees was presented. The individual sessions contained more details on some of the changes. For example the session on Math 124-5-6 discussed changes in syllabus, text, and format in the standard calculus course. The session on Math 111 offered a chance to attend a class and then discuss objectives and methods used to achieve them. In the session on 300 level courses, changes in the 300 level offerings, some of which are dictated by the change in the syllabus of Math 124-5-6, were discussed. More information on this Symposium is available from Professor Jim Morrow, morrow@math.washington.edu. Beginning next year, we will offer a sabbatical program for community college math teachers to develop closer ties to ease the transition for students moving from community colleges to the University of Washington.

## CALCULUS CHANGES UNDER WAY

Significant changes are being implemented in the teaching of calculus by the Mathematics Department at the University of Washington. These changes are the culmination of three years of reviewing the calculus program, visiting other departments around the country, and experimenting with many formats.

Math 111/112 (Business Calculus) is starting its third year with reduced class size. The Math Study Center has been remodeled and expanded to include Math 111/112. The university administration provided the funding for the remodel.

The standard three-quarter calculus sequence is being revamped in a number of ways. The first change is the addition of two new calculus sequences, Math 127-8-9 and Math 144-5-6, which are being offered now for the second year. Math 127-8-9 is designed for students interested in the mathematical sciences. Math 144-5-6 includes some probability, and is designed for students interested in the biological sciences and psychology. A Math Services Committee has been formed to help us keep in touch with and address the needs of our client departments and their students.

In addition to introducing two new calculus sequences, our basic service course, Math 124-5-6, is being revised substantially. Math 124-5-6 is designed for students interested in the physical sciences and engineering. The content is changing as are the text books. With these changes our syllabi will align better with those of other institutions, making the transition into our courses easier for transfer students. The syllabi will continue to emphasize a problem solving approach to teaching calculus, which has been one of the strong points of our courses.

The other major change involves class size and the organization of quiz sections in our three-quarter calculus sequences. The goal will be to offer these courses with a maximum lecture size of 80 instead of 160, and a maximum quiz section size of 27 instead of 40. In addition, one of the two weekly quiz section meetings will be extended from 50 to 75 minutes, giving much greater flexibility to the quiz sections. Many of these longer quiz sections will use more extensive worksheets, which are currently being developed. We will start using this format in some test sections of the first two quarters of the three-quarter sequences in Spring 2001, and then convert all of Math 124-5, Math 127-8, and Math 144-5 to the new format by Autumn 2001. The Mathematics Department has submitted a "Tools for Transformation" proposal to help support these changes. The department is very pleased with the encouragement and support it has received from many parts of the university administration to proceed with these changes.

## ATTENTION HUSKY FANS!

Did You Know That You Can Now Earn Tyee Points by Contributing to the Mathematics Department?

Members of the Tyee program who currently receive priority seating in Husky Stadium (Tyee seats) and Hec-Edmundson Pavilion (Key 100 and Fast Break seats) can receive Tyee points for contributions to academic programs within the University if they give at the President's Club level ($2000 and above). These points are transferred to the Tyee account each January for the previous calendar year's gifts.

Details of the Tyee Points program are at the Husky sports home page (www. gohuskies.com). Under "Online Store" choose "Donors"

## OUR DONORS

The following is a list of our friends who have contributed to the Department between July 1, 1999, and June 30, 2000. Should you notice an error or omission in this list, please draw it to our attention by a telephone call or e-mail message to our Chair, Professor Donald Marshall (206-543-1151).

Amy Emiko Yoshihara and Roy Abe
Patrick Alison
Noel and Donald Anger
Elsie and Loren Argabright
Judith Arms and Stan Sorscher
Carol and Charles Austin
Alfred Beebe and Shauneed Giudice
John and Tasoula Berggren
Ann Birnbaum
Hilde and Z. William Birnbaum
Robert and Sarah Blumenthal
Neil Bogue
Phillip Bombino
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Kenneth Bube
David and Pairat Bushnell
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Mark Hartman
Jeffrey Hendershot
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The Department is grateful for the gifts it receives from its alumni and friends. These gifts make it possible for us to engage in activities that are of genuine value to our students and our faculty—see some of the stories in this Newsletter—but for which there is no state funding.

One form that this support can take is testamentary bequests. Three of the Department's endowments have come as bequests made in the wills of former faculty members.

You need not be a millionaire to leave a legacy for future generations. You simply need to write a will and include a gift to the institutions and causes you care about. A bequest to the Department of Mathematics can be part of your legacy, supporting students, faculty, research, teaching—whatever you most value from your experience in the department. Your bequest can be a specific dollar amount or a specified portion of your assets. Every gift makes a difference. Each gift stands as its own legacy and adds to the tradition of excellence in the department.

If you would like information about how to include the department in your will or living trust, or if you have already done so and would like to let us know, please contact our Chair, Professor Don Marshall (206-543-1151) or Dondi Cupp, the development officer of the College of Arts and Sciences who works with the Mathematics Department. His telephone number is 206-685-6736.

## TWO VIEWS OF MATHEMATICS

"Thus mathematics may be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true."

–Bertrand Russell, *Mathematicians and the Metaphysicians*.

"Mathematics, rightly viewed, possess not only truth but supreme beauty—a beauty cold and austere, like that of sculpture."

–Bertrand Russell, *Mysticism and Logic*.

## GEOMETRY FESTIVAL HONORS GRÜNBAUM AND KLEE

Our colleagues Branko Grünbaum and Victor Klee were honored by the *Klee-Grünbaum Festival of Geometry* held in Ein Gev, Israel, from April 9 to April 16, 2000.

The conference dealt with various aspects of the theory of convexity in Euclidean space, with special attention to the discrete, applied, combinatorial and computational aspects of the theory, subjects to which the honorees have made important contributions. A total of ten invited lectures were presented by the honorees and by other distinguished workers in the field. In addition to these invited lectures, there were many contributed talks; one day saw a total of seventeen!

More than sixty mathematicians from around the world attended the meeting, among whom were many who have been colleagues and friends of Professors Grünbaum and Klee for many years. Four of the Department's graduate students, Leah Berman, Shawn Cokus, Jed Mihalisin, and Gordon Williams, attended the meeting.

The organizing committee consisted of Shmuel Onn of Technion and Shlomo Reisner and Joseph Zaks of Haifa University. Professor Zaks is an alumnus of this department. The meeting was sponsored by the European Mathematical Society, the Israeli Mathematical Union, the Emmy Noether Institute at Bar Ilan University, the University of Haifa and Technion-Israel Institute of Technology.

The web page for the meeting is http://iew3.technion.ac.il:8080/~kgfest/

## CONFERENCE HONORS KLEE

In anticipation of Professor Victor Klee's seventy-fifth birthday on September 18, 2000, a three-day conference "VK75" was held in his honor. Professor Klee, a member of the Department since 1953, has over 240 publications and is the recipient of numerous awards and honors. By the end of the current academic year, he will have graduated a total of thirty-six PhD students. The conference, which took place August 14th–16th at the Center for Urban Horticulture on the campus of the University of Washington, enjoyed over fifty participants, including several from Israel, Canada, and the United Kingdom. The format of the conference allowed each day two one-hour main lectures and several workshops, discussion sessions, and opportunities for informal interaction. While somewhat unusual, many attendees seemed pleased with the format. The invited speakers were Eric Babson, Branko Grünbaum, Gil Kalai, Ravi Kannan, László Lovász, Bernd Sturmfels, and Victor Klee. The conference was organized by two of Professor Klee's current graduate students, Shawn Cokus and Jed Mihalisin, who gratefully acknowledge the Department of Mathematics, the Milliman Fund, and the UW Graduate School for financial support.